

IBM

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Networking

Ethernet on iSeries







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iSeries

Networking

Ethernet on iSeries



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## Part 1. Ethernet

Ethernet on the iSeries supports TCP/IP, Advanced Peer-to-Peer Networking® (APPN), advanced program-to-program communications (APPC), Retail, Finance, Host and RWS.

To configure and manage TCP/IP or SNA over Ethernet on your iSeries, see the following information:

- | • **Print this topic**
- | • **Understand Ethernet Support**  
| Know what types of frames, connections, and functions Ethernet supports, and how to implement them.
- | • **Manage Ethernet support**  
| You can use existing line descriptions with iSeries Navigator by assigning it to a TCP/IP interface,
- | • **Tune Ethernet performance**  
| Increase your data throughput and Ethernet performance by adjusting the default values of your configuration objects.
- | • **Troubleshoot Ethernet**  
| Having problems with your server and connections? Get tips on why connections might fail, why frames are dropped, or why PCs cannot connect to your system.





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## Chapter 1. What's new for V5R2



| This release, 2 new Gigabit Ethernet input/output adapters (IOA) are available . The 5701 is a Unshielded Twisted Pair (UTP) card, that uses copper wire cabling. The 5700 is Gigabit Ethernet card that uses fiber optics. These cards support Transmission Control Protocol/Internet Protocol (TCP/IP), jumbo frames, and the IEEE 802.3 standard.


| Also introduced this release is the 2849 10/100 Base T input/output adapter (IOA) card that uses copper wire cabling. The 2849 supports Transmission Control Protocol/Internet Protocol (TCP/IP), the IEEE 802.3 standard, and SNA over 10 and 100 Mbps Ethernet.

| All 3 of these cards are available for use on V5R2, or later, systems.

### | **How to see what's new or changed**

| To help you see where technical changes have been made, this information uses:

- | • The  image to mark where new or changed information begins.
- | • The  image to mark where new or changed information ends.

| To find other information about what's new or changed this release, see the Memo to Users 



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## Chapter 2. Print this topic


To view or download the PDF version, select Ethernet (about 164KB or 30 pages).

### Saving PDF files

To save a PDF on your workstation for viewing or printing:

1. Right-click the PDF in your browser (right-click the link above).
2. Click **Save Target As...**
3. Navigate to the directory in which you would like to save the PDF.
4. Click **Save**.

### Downloading Adobe Acrobat Reader

If you need Adobe Acrobat Reader to view or print these PDFs, you can download a copy from the Adobe Web site ([www.adobe.com/products/acrobat/readstep.html](http://www.adobe.com/products/acrobat/readstep.html))  .



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## Chapter 3. Ethernet support

Many different factors influence the capabilities of Ethernet. Some of these influences can come from the cabling and adapter type you use. Limiting factors can be the capabilities of the hub or switch that you connect to, the frame size you are able to transmit and receive, and the type of connection you use.

For more detailed information and some explanations of the terminology and technology available to you, see the following:

- **Ethernet commonly used terms**  
Understand the terms that are used in reference to Ethernet networking.
- **Ethernet Capabilities**  
Find out what Ethernet capabilities, such as line speed, duplex mode and others, can enhance your server's performance
- **Establish a physical connection to your network**  
Ensure you configure the correct line speed and duplex mode for your connection.
- **Ethernet input/output adapters (IOAs)**  
Find out what IOAs are supported and what capabilities each one has.
- **Ethernet frame format**  
Know how to interpret the data contained in your Ethernet frames by understanding the frame formatting.
- **Maximum Ethernet frame sizes**  
The maximum frame size your server can support depends on the maximum size that all the devices on your LAN can support.
- **Connect LAN devices**  
The correct line and controller descriptions will help you achieve successful connections.
- **SNA connections to LAN protocols**  
You can connect your server to a LAN using SNA, and can have multiple service access points.

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### Ethernet commonly used terms

The following terms are some common items that are referred to from time to time. Some of the terms defined can be used to represent multiple meanings. The terms and definitions used here are meant to specifically represent Ethernet networking technology, related information, and devices.

#### Link partner

The 10BASE-T, 100BASE-TX, or 1000BASE-TX connection is established between the adapter card and the hub or switch port to which it is connected. The line speed and duplex characteristics of this link may be different from any other connection in the network.

**Hub** A half duplex device that usually sums all of its inputs and then broadcasts that sum on all outputs (to all connected adapters). The hub has a large collision domain and shared media.

#### Switch

A half or full duplex device that learns which devices are attached at each port and passes only frames addressed to those devices on that port. The switch has a small collision domain, if any.

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### Ethernet capabilities

The iSeries is capable of transmitting and receiving data at speeds from 10 megabits per second (Mbps) to one gigabit per second (Gbps or 1000 Mbps). Functions such as full duplex also enhance the communication speeds and the overall performance of Ethernet. For more specific information on these types of capabilities, see the following:

- Line speed

- Duplex Mode
- Gigabit Ethernet
- Auto-negotiation
- Auto-sensing

## Line speed

The speed of data transfer is limited by the connection type, cabling, and maximum speeds that your server and link partner you are connecting to can support. These speeds can be 10, 100, or 1000 Mbps (1 Gbps).

The cable type you use will directly limit what speed you can transmit and receive data. For more information on cabling types and their capabilities, see [Cabling specifications](#).

The maximum line speed of your server is also affected by the type of input/output adapter (IOA) that you are using. More specific information on each supported IOA is available in [Ethernet IOAs](#). For general comparison information between the two Gigabit Ethernet adapters, see [Gigabit Ethernet](#).

## Duplex mode

Depending on your server's capabilities and the duplex mode of the link partner you are attaching to, you can use either full or half duplex.

Half duplex mode will restrict the server to one way communication; it cannot transmit and receive data at the same time. Full duplex allows your server to send and receive data simultaneously. You must match your servers duplex mode to that of your link partner. If you do not, a duplex mismatch can occur.

## Gigabit Ethernet

The iSeries server supports Gigabit Ethernet, which requires the use of a 1 Gbps input/output adapter (IOA). There are four IOAs that can be used to run Gigabit Ethernet, the 2760 and 5701 Unshielded Twisted Pair (UTP) cards, that use copper wire cabling, and the 2743 and 5700 Gigabit Ethernet cards, that utilize fiber optics. All four of the adapter cards support Transmission Control Protocol/Internet Protocol (TCP/IP), jumbo frames, and the IEEE 802.3 standard. SNA is not supported over Gigabit Ethernet.

**Note:** You must have a new V5R2 machine, or later, to use the 5700 and 5701 adapters.

To use the UTP adapter cards, you must have V5R1 or later. The cards have the capability of running 10/100/1000BASE-T and full or half duplex mode. The recommended minimum cabling type for use between these cards and their link partner is Category 5e, which has 4-pair, twisted copper wiring. All four pairs are used when running Gigabit Ethernet. The cable and connectors must also be wired to TIA/EIA 568-A standard (straight through, no cross over).

You must be running V4R5 or a later version to use the fiber optic Gigabit Ethernet cards. These IOAs only support 1000BASE-SX and full duplex mode. The IOAs do not support auto-negotiation. The recommended fiber to use with these IOA is 50 or 62.5 micron mm fiber.

Ethernet frames can contain anywhere from 64 to 9000 bytes of information. The maximum frame size supported by all four cards is the jumbo frame (up to 9000 bytes). The amount of work for the adapter card to process each frame, regardless of size, is nearly the same. Therefore, you want to pack the most information possible into each frame. This enhancement in frame size will also decrease CPU utilization, leaving it more available for other application usage.

**Note:** To maximize performance and to use jumbo frames, the switch or hub and devices that your system connects to must also support Gigabit Ethernet.

| In addition to these 4 IOAs, the iSeries server supports the 2849 10/100 Base T input/output adapter (IOA)  
| on new V5R2 machines. This card uses copper wire cabling. The adapter card supports Transmission  
| Control Protocol/Internet Protocol (TCP/IP), the IEEE 802.3 standard, and SNA over 10 and 100 Mbps  
| Ethernet.

For more information about these and other IOAs, see Ethernet IOAs. See Cabling specifications for more information on cable types and the speeds they support.

## Auto-negotiation

Auto-negotiation allows your server and its link partner to quickly establish a connection. However, auto-negotiation does have some limitations. If your link partner is not configured to auto-negotiate, you must configure your server's line speed and duplex to match that of the link partner.

Auto-negotiation uses ethernet link pulses to transfer configuration data between your server and the link partner. Each partner shares its supported values for line speed and duplex mode, then finds the highest common value for each. The first values common to both partners are selected.

The values for line speed and duplex are chosen in the following order:

- 1000 Mbps full duplex\*
- 1000 Mbps half duplex\*
- 100 Mbps full duplex
- 100 Mbps half duplex
- 10 Mbps full duplex
- 10 Mbps half duplex

\*For Gigabit Ethernet, the line speed is negotiable only when using the UTP card, since this card has 10/100/1000BASE-T and full or half duplex capabilities. The fiber optic Gigabit Ethernet adapter card can only run 1000BASE-SX and full duplex.

If auto-negotiation fails, the iSeries will auto-sense the line speed of your link partner. However, you need to be aware that this can cause a duplex mismatch.

## Auto-sensing

If your server is configured to auto-negotiate, but the auto-negotiation fails, your server can sense the line speed of the port it is attempting to connect to. It will automatically set the line speed to match that of the link partner. Because the IEEE 802.3 Ethernet standard does not support auto-sensing the duplex mode, the adapter cannot sense the duplex mode. The iSeries 400 will default to half duplex, which can result in a duplex mismatch.

The following is an example of a duplex mismatch: Your iSeries, configured for full duplex, is connecting to a hub configured for half duplex. The iSeries begins sending information to the hub, which is waiting to receive. Once the receive line is clear, the hub will then begin transmission back to the iSeries. During this transmission, the iSeries receives the incoming data and (if it has data ready) begins transmitting to the hub. Because the hub is half duplex, it will see this unexpected receipt of data and will abort the transmission in progress. This is called a collision.

The iSeries will drop the aborted frames received from the hub because the frame check sequence (FCS) will not match. The iSeries will log a CRC error, but will not see the collision; only the hub sees the collision. The iSeries will continue to transmit and receive simultaneously. The hub will begin its transmission again, once the receive line is clear. If another unexpected receive occurs, the transmission will again be aborted, and this cycle will continue.

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## Establish a physical connection to your network

The first step to using Ethernet for the iSeries is establishing a physical connection to your network. Having the correct settings and configurations for your server will help ensure a successful connection. The physical link includes using the correct cabling and configuring the correct line speed and duplex mode to match the capabilities of the link partner you are connecting to.

### Cable specifications:

The cabling that you use to connect to your link partner must be wired to the TIA/EIA 568–A standard (straight through, no cross-over). There are different categories of cables and each one supports different speeds.

- Category 3: supports 10 Mbps
- Category 5: supports 10/100/1000 Mbps
- Category 5e\*: supports 10/100/1000 Mbps

\*Category 5e is recommended if you are running Gigabit Ethernet. This cable type has tighter specifications that will help you achieve better quality connections.

Connecting your cables can be tedious work. The table below lists the pairs of wires inside the cable and shows what order they are wired in the RJ-45 connector. It is crucial that the connector pins be in this order, or you will not be able to connect to your link partner. You will notice that the wires are different colors; some are solid colors and some are half solid and half white. Each half solid and white wire is paired with the corresponding solid color wire, even though they might not sit adjacent to one another in the connector.

The pairs of wires are:

- White/green, solid green
- White/orange, solid orange
- White/blue, solid blue
- White/brown, solid brown

The pins are numbered from left to right. (Hold the connector latch down and point the contacts away from you, so that pin 1 (White/Green) is on the left.) The table below shows how the wires appear in the connector and what pins they are set into.

Connector Pin	Wire Color
1 2	White/Green Green
3 4	White/Orange Blue
5 6	White/Blue Orange
7 8	White/Brown Brown

### Line speed and duplex mode configuration:

If your link partner is capable of auto-negotiation, you can use \*AUTO for both line speed and duplex mode, to auto-negotiate. If you are unsure of your link partner's capabilities, find out what line speed and duplex mode it is set to, so you can configure your server to match.



For example, the hub or switch port is set to 100 Mbps and half duplex (not capable of auto-negotiation). In CRTLINEH, set your iSeries parameters to Linespeed = 100, Duplex = Half. Do not use \*AUTO for either of these parameters, in this case.

Do not use any of the following line speed and duplex mode configurations:

- 10/\*AUTO
- 100/\*AUTO
- \*AUTO/Half
- \*AUTO/Full

These configurations might work, but you will have frequently unsuccessful and incorrect connections.

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## Ethernet IOAs

The iSeries supports the Ethernet adapters shown in the following table:

*Table 1. Supported Ethernet adapters*

IOA	Speed	Auto-negotiation supported	Jumbo frames supported	TCP/IP	SNA	Duplex mode capability	
						Full	Half
2760 <sup>1</sup>	10/100/1000 Mbps	X	X	X	—	X	X
2743 <sup>2</sup>	1000 Mbps (1 Gigabit)	—	X	X	—	X	—
2838 <sup>3</sup>	10 Mbps and 100 Mbps	X	—	X	X	X	X
2723	10 Mbps	—	—	X	X	X	X
5700 <sup>2</sup>	1000 Mbps (1Gigabit)	—	X	X	—	X	
5701 <sup>1</sup>	10/100/1000 Mbps	X	X	X	—	X	X
2849 <sup>1</sup>	10/100 Mbps	X	—	X	X	X	X
6181	10 Mbps	—	—	X	X	X	X

1. Unshielded Twisted Pair (UTP) card; uses copper wire cabling  
 2. 1 Gigabit Ethernet card; uses fiber optics  
 3. You can now run SNA traffic with TCP/IP traffic on this IOP/IOA. TCP/IP traffic will run in the higher performance path along with SNA traffic.

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## LAN IOA addresses

The IOA will have a preset address (also known as the burned-in address or the manufacturer-assigned address). But, you have the option of setting the address for each input/output adapter (IOA) to an address of your choice.

If you are using SNA, it is recommended that you use an address of your choice. For example, if you use the burned-in address of the adapter, you must configure this address into every device that communicates with the adapter. If, at a later point in time you replace the adapter, you must go back to each device and reconfigure them with the burned-in address of the new adapter. You cannot assign the burned-in address of the old adapter to the new adapter.

However, you can avoid the excess reconfiguration work by associating a locally administered address with the adapter. Since the other devices will already have the locally administered address configured, you will not need to reconfigure them when you replace the IOA. Instead, you can associate the existing locally administered address with the new adapter.

**Note:** No two adapters in the same network can have the same address.

Another item that you may want to consider is whether to use the default source service access points (SSAPs) or to define your own. For more information and guidelines about service access points (SAPs), see SNA connections to LAN protocols.

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## Ethernet frame format

While tracing LAN communications, you may need to look at the transmitted frames. To understand the data that is contained in the frame, you must know how it is formatted. The figures below show the frame format of two Ethernet standards: IEEE 802.3 and Ethernet version 2.

The Frame Check Sequence (FCS) is a part of the frame put in place to verify that the information each frame contains is not corrupted during transmission. If a frame is corrupted during transmission, the FCS on the frame will not match with the recipient's calculated FCS. Any frames that do not match the calculated FCS will be discarded.

### IEEE 802.3 frame format:

Starting Delimiter (1 byte)	Destination Address (6 bytes)	Source Address (6 bytes)	Length (2 bytes)	LLC header and Information field (46 - 1500 bytes)	Frame Check Sequence (4 bytes)
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### Ethernet version 2 frame format:

Starting Delimiter (1 byte)	Destination Address (6 bytes)	Source Address (6 bytes)	Type (2 bytes)	Information field (46 - 1500 bytes)	Frame Check Sequence (4 bytes)
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Ethernet version 2 supports SNA by placing the IEEE 802.2 LLC header and data into the information field. It also puts value X'80D5' into the Type field. This shows the frame format.

SD	DA	SA	Type (80D5)	Information field (Length, Padding, LLC header, Data)	FCS
SD - Starting delimiter DA - Destination address SA - Source Address FCS - Frame check sequence					

**Note:** SNA is not supported with Gigabit Ethernet.

## Types of Ethernet frames sent

The Ethernet frame that your server receives and the Ethernet standard that you select in the line description govern the type of frame that your server sends. As noted in the table below, your server will not send a frame in some cases. In the line description, you select the standard through the Ethernet standard (ETHSTD) field. In an SNA environment, if you have the option to use Ethernet standard IEEE 802.3 or Ethernet version 2, use \*ALL.

The following table shows what Ethernet frame your server sends according to the frame type the server receives and the value of the ETHSTD field.

Frame type received	ETHSTD value	Frame type sent
IEEE 802.3 with SNA or non-SNA data	*IEEE8023 <sup>1</sup>	IEEE 802.3
	*ETHV2 <sup>2</sup>	No frame sent
	*ALL <sup>3</sup>	IEEE 802.3
Ethernet version 2 with non-SNA data	*IEEE8023	No frame
	*ETHV2	Ethernet version 2
	*ALL	Ethernet version 2
Ethernet version 2 with SNA data	*IEEE8023	IEEE 802.3
	*ETHV2	Ethernet version 2, encapsulated SNA <sup>4</sup>
	*ALL	IEEE 802.3

1. The network uses Ethernet standard IEEE 802.3.
2. The network uses Ethernet version 2. In an SNA environment, you use this protocol for only iSeries-to-iSeries communications.
3. The network uses both Ethernet standards (IEEE 802.3 and Ethernet version 2). All TCP/IP multicast packets are sent as 802.3 and Ethernet version 2 frames.
4. The type field of the Ethernet version 2 frame to indicate the information field contains the SNA data.

## Maximum Ethernet frame sizes

The largest frame size used during the connection process is controlled by the maximum frame size configurations of multiple items. The maximum frame size for the connection is also influenced by exchange identifier negotiations and bridge considerations. Note that TCP/IP and SNA connections are limited by slightly different sets of items.

**TCP/IP connections:** The maximum frame size associated with:

- the Ethernet standard that you select
- the line description (Gigabit Ethernet only)
- each service access point (SSAP)
- the TCP/IP interface

**SNA connections:** The maximum frame size associated with:

- the controller
- the Ethernet standard that you select
- each service access point (SSAP)

During the connection process, your server selects the smallest common value of the maximum frame values. As stated above, the actual maximum frame size used can become even smaller, if the bridge cannot support the value selected by the server. See the example on Bridges dropping frames for more information on how it can affect your maximum connection frame size.

The following table shows the maximum frame sizes that are associated with the Ethernet standard that you select through the Ethernet standard (ETHSTD) field.

ETHSTD parameter value	Frame type used	Maximum frame size in bytes	
		SNA <sup>4</sup> on page 14	TCP/IP
*IEEE8023 <sup>1</sup> on page 14	IEEE 802.3	1496	8992 (gigabit Ethernet) 1492 (all others)

ETHSTD parameter value	Frame type used	Maximum frame size in bytes	
		SNA <sup>4</sup>	TCP/IP
*ETHV2 <sup>2</sup>	Ethernet version 2	1493	9000 (gigabit Ethernet) 1500 (all others)
*ALL <sup>3</sup>	IEEE 802.3	1496	8992 (gigabit Ethernet) 1492 (all others)
	Ethernet version 2	1493	9000 (gigabit Ethernet) 1500 (all others)

1. IEEE 802.3 standard.
2. Ethernet version 2 standard.
3. Network uses both Ethernet standards (IEEE 802.3 and Ethernet version 2).
4. Not all Ethernet lines support the SNA protocol.

## Maximum LAN frame sizes

The larger your frame size, the more data your server can pack into it. Hence, you can increase your data throughput. Usually you set the maximum frame size to the largest size that is supported by your input/output adapter (IOA). However, a device along the way will drop the frame if it cannot support the larger size.

For example, if frames are being sent to a remote system on a different LAN, the frame must be go through a bridge to be retransmitted to the remote LAN. If the bridge cannot support the frame size that your LAN is using, the frame will be dropped or discarded. In the Ethernet environment, no indication of the smaller frame size of the bridge is received. The problem will be detected when a connection with the remote system is established and a CPA57A1 message is sent to the configured message queue.

If you cannot configure the device to support your frame size, you must decrease your maximum frame size to a size that the device can support. You can change one or more of the following maximum frame size fields (location of the field in parenthesis):

- SSAP maximum frame parameter (line description)
- Maximum frame size (line descriptions for token ring and Gigabit Ethernet networks)
- Maximum frame size (controller description)

If any adjustments are made, it is recommended that the MAXFRAME value on the controller description be adjusted as well.

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## Connect LAN devices

If you use SNA with a LAN protocol, this information will help you to successfully connect to a remote system. The correct relationship between a line description and a controller description helps to ensure connection establishment. A controller description determines which line descriptions your server uses. Therefore, you must ensure that the controller description refers to the correct line description.

A line description also governs the number of active controllers that can access it. By setting the MAXACT parameter number too small, you might prevent the controller from accessing the server over the specific line description. Therefore, you should set a large enough value to ensure the controller access to the line.

The descriptions must also contain the correct information to ensure connection establishment. The following information discusses further details on choosing connections and identifying information:

- LAN device identification
- LAN device connection initiation

## LAN device identification

To begin a connection, your server sends information to the remote device you are connecting to. The device identifies the server using this information. The device then sends information back to the server, which the server uses to identify the device. The server compares that information against the information that is contained in the line and controller descriptions. If a match occurs and other connection values are correct, the connection process continues. In the meantime, the remote device performs a similar process.

Your server and the remote device use two types of verification during the connection process. The first type (required), matches the line and controller description information with the connection information that the remote device sent. Once the information has been verified, your server continues the process.

The remote device sends the following information:

- The MAC address associated with the input/output adapter (IOA) on the remote device (either preset or locally administered)
- The source service access point (SSAP) on the remote device
- The destination service access point (DSAP)

The other type of verification matches the SNA exchange identifier values. SNA hosts that use parallel connections require this verification. This verification is optional for advanced program-to-program communications (APPC).

## SNA exchange identifiers (XIDs)

The exchange identifier is defined in the controller description for your server. To establish a connection, your server and the remote device both send an XID. SNA hosts that use parallel connections require the XIDs. Your server conducts an initial poll with NULL XIDs during the connection process, to determine whether or not the remote device is active. If the device responds to the poll, your server and the remote device exchange XIDs and establish the connection.

The controller description for an SNA host names the XID value as the local exchange identifier. The APPC controller description names the XID value as the exchange identifier. Other controller types, such as CTRL, FNC, and RWS, also use the exchange identifier.

## LAN device connection initiation

In an SNA environment you can determine who initiates the connection request and who waits for an incoming connection request. To have your server initiate the connection, you can configure the controller description to dial the destination. If no connection is established, your controller description automatically switches to answer mode.

To have your server wait for incoming calls, you can configure the controller description to answer the incoming calls. You specify the mode through the Initial connection (INLCNN) field of the controller description:

### Dial mode (SNA)

SNA controller descriptions use dial mode to send a connection request to a remote device. Dial mode usually starts when varying on the controller description. However, if the DIALINIT parameter is set to \*DELAY, dial mode will not begin until an application opens a file that uses the connection. During the dialing process, the server polls the remote device to determine if the device is available. If the remote device is available, the connection process continues. Successful connection is still possible even if the local and remote devices dial each other simultaneously.

The controller description fields below set the frequency and duration of the poll:

- LAN connection retry (LANCNRITY) determines the number of times your server polls the remote device.
- LAN connection timer (LANCNTMR) determines the length of time between each poll.

If the remote device answers the poll within the time specified by the parameters, your server proceeds with establishing the connection. If not, your server sends an inquiry message (CPA58E0 or CPA57EF) to the configured message queue. This message indicates that a connection attempt failed and that the controller description is now in answer mode.

### **Answer mode (SNA)**

If you specify answer mode, the input/output adapter (IOA) does not originate connection requests, but will respond to incoming connection requests. Servers with controller descriptions that are configured with dial mode will initiate and accept connection requests. However, APPC controllers that are user owned (CTLOWN = \*USER) must be varied on before the server can respond to connection requests.

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## **SNA connections to LAN protocols**

The server can connect SNA to a LAN protocol by using service access points (SAPs). Multiple SAPs allow you to have multiple connections between SNA and a LAN protocol, thus permitting multiple communication paths between independent applications.

You or the server specifies the SAPs to use in the line and controller descriptions. For SNA, the server can automatically create one SAP value (the default value). You might want to change this value or have additional SAPs if any of the following conditions apply:

- The remote system does not use the default source service access point (SSAP)
- You want parallel station-to-station connections between adapters (This may be desirable if you link two applications that require different controller descriptions.)
- You want station-to-station connections to the same adapters (You may want to do this to configure multiple SAPs to test an application on a single system.)

If you plan to change the SAP defaults, see SNA service access points for guidelines and other information.

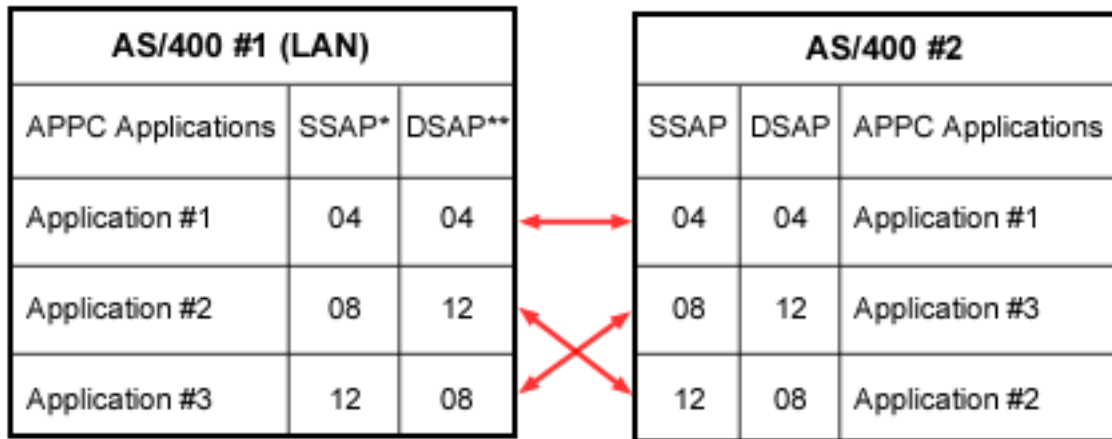
### **SNA service access points (SAPs)**

On the server, you define the source SAPs (SSAP). If you decide to change the default SAPs or add more SAPs, you must define them in the line and controller descriptions. You can specify up to 24 SSAPs per line description when you define the SAPs. The SSAPs that your controller description uses must also be defined in the line description associated with the controller description. Your controller description also specifies the destination service access point (DSAP).

Local SAPs are known as source service access points (SSAPs). The remote SAPs are known as destination service access points (DSAPs). Your server sends data from an SSAP to a DSAP.

The illustration below shows an example of the relationship between SSAP and DSAP pairs:

### Example of SSAP and DSAP Pairs



\* The LAN source service access point (SSAP) is the logical address that this server sends with any data to a remote system. This value must match the DSAP of the remote controller.

\*\*The LAN destination service access point (DSAP) is the logical address with which this controller communicates. This value must equal the LAN SSAP in the remote controller configuration.

For SNA, you must use certain SSAP values. You can find the help for selecting these values by pressing F1 (Help) while your cursor is on the SSAP list field of the line description.





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## Chapter 4. Configure Ethernet support

You will need to use iSeries Navigator to configure TCP/IP over Ethernet. To configure SNA over Ethernet, you must create a line and controller description, and in some cases, a device description.

To configure Ethernet support, see the following information:

- Configure TCP/IP over Ethernet
- Configure SNA over Ethernet

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### Configure TCP/IP over Ethernet

You will use iSeries Navigator to configure Ethernet support for TCP/IP. To configure your server, complete the following steps:

1. Install iSeries Navigator. (If this has previously been installed, skip to step 2.)
2. In the iSeries Navigator window, expand the iSeries that will provide Ethernet support for TCP/IP. Log onto the server if you are prompted to do so.
3. To use the EZ-Setup Wizard to configure a new TCP/IP interface that will be used with Ethernet:
  - Click on **Network**.
  - Right click on **TCP/IP** and select **New Interface**.
  - Click on **LAN**. This will take you to the Configuration Wizard.

Remember:

- You can choose to use an existing line description or have a new one created by iSeries Navigator.
4. If you did not choose to turn on the TCP/IP interface, you can do so now. Follow the instructions in Starting the TCP/IP interface.

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### Configure SNA over Ethernet

To configure Ethernet support for SNA complete the following from an interactive job:

1. Create the Ethernet line description. When creating the line description, ensure the correct configuration of these fields:
2. Create the controller description.
3. Create a device description.
4. Vary on configuration objects.

### Select a LAN IOA

Before creating your line description, you must select the input/output adapter (IOA) to use with it. Use the Work with Hardware Resources (WRKHDWRSC) command to identify the name of your IOA and select the IOA. To do this, complete the following steps (even if you know the name of the IOA):

1. Type WRKHDWRSC \*CMN and press Enter. A list will appear that shows the attached iSeries communications resources, and their type numbers, operational statuses, and descriptive text.
2. Locate an IOA by looking in the descriptive text column for a phrase that describes the port for your LAN type. For example, if you use Ethernet, look for "Ethernet Port."
3. Once you find an IOA, move your cursor to its Opt field.
4. Type 5 (Work with configuration descriptions) and press Enter.
5. Type 1 (Create) and press Enter.

### Create the Ethernet line description

If you want to create a line description to use with TCP/IP, see Configuring TCP/IP over Ethernet. To configure a new Ethernet line description to support SNA, complete the following steps:

**Note:** The steps below describe only the fields that require additional information. If you need help with the fields that are not discussed here, press F1 (Help) when your cursor is on the field in question.

1. Select an IOA to use with your line description. If you are not familiar with the capabilities of the IOAs, see Ethernet IOAs for more information.

You are now in the Create Line Description (Ethernet) (CRTLINETH) screen. Note that the server enters the IOA you selected into the Resource name field.

To move from field to field, move your cursor or press the tab key. Do not press Enter while you are in this screen unless instructed to do so; otherwise you will exit the command.

2. Type a name for your line description into the Line description field.
3. Indicate the address to use with the IOA in the Local adapter address field. You can use either the preset address or a locally administered address. If you are unsure which address to use, see LAN IOA addresses.

To use the preset address, accept the default value of \*ADPT. To specify a locally administered address, enter a valid address into the field. For guidelines on creating a valid address, move your cursor to the address field and press F1 (Help).

4. If the server uses this line description to communicate with an SNA host through a parallel connection, specify a value other than \*LIND in the SNA Exchange identifier field.
5. In the Ethernet standard field, specify the standard to use. If you can use SNA over IEEE 802.3 or Ethernet version 2, use the \*ALL value on the ETHSTD parameter.

For information about how the selected standard influences the type of Ethernet frame your server sends, see Ethernet frames sent.

**Note:** You cannot change this field after exiting the command.

6. In the Line speed field, indicate the line speed to use (1G for TCP/IP only). If you do not know the capabilities of the IOA, see Ethernet IOAs.

**Note:** Line speed automatic negotiation occurs when you specify \*AUTO.

7. Select the duplex mode to use with your IOA. If you do not know the capabilities of the IOA, see Ethernet IOAs.

**Note:** Duplex mode automatic negotiation occurs when you specify \*AUTO. Remember that your Ethernet switch or hub must support automatic negotiation before you can successfully use this function. If the device does not support it, a duplex mismatch can occur, causing connection problems.

8. Press F10 (Additional fields).
9. List all the source service access points (SSAP) that your controller description can use in the SSAP field. Accept the default value \*SYSGEN or specify your SSAPs. To define the SSAP values, move your cursor to the field and press F1 (Help) for help to determine what values to use.


For more information on whether you or the server should define the service access points (SAPs), see SNA connections to LAN protocols.

10. Leave the SSAP maximum frame field blank.
11. (This step is optional.) In the Autocreate controller field, specify \*YES if you use APPN and want the server to create a controller description. (The server will create the description when a call comes in.) If you specified \*YES, you do not need to create a device description.
12. Press Enter to create the line description. Your line description will appear at the bottom of the list.
13. Press enter twice.

## Create the SNA controller description

The controller description identifies the remote devices to which the server connects. To create a controller description to use with your LAN adapter, complete the following steps:


1. If you are running APPN, your server can autocreate the controller description (suggested method) or you can create it manually. Autocreate cannot be used with APPC.
2. Type the name of the command to use and press F4 (Prompt). Type G0 CMPCTL to find a list of controller commands.
3. Type the name of the controller description into the Controller description field.
4. Specify \*LAN in the link type field.

5. Press Enter three times.
6. The server displays more fields that may require the following information (for more help, press F1 (Help) while your cursor is on the field):
  - **Switched line list:** specifies one or more line descriptions that your controller description can use. For more information about the relationship between the line and controller descriptions, see Connecting LAN devices. Enter the name of your Ethernet Line Description.
  - **Initial connection:** determines whether the controller description initiates connection requests (\*DIAL), or waits for incoming connection requests (\*ANS).  
If you specify \*DIAL and want to adjust the polling duration or frequency, you can change the LAN connection retry (LANCNRRTY) or LAN connection timer (LANCNTTMR) field.
  - **LAN remote adapter address:** contains the address of the remote input/output adapter (IOA). To locate this address, see Viewing the LAN IOA address. If you are using the preset address of the adapter, consider using your own LAN IOA addresses to minimize your reconfiguration work.
  - **LAN DSAP:** contains the source service access point (SSAP) value from the controller description that is for the remote device. For more information about service access points (SAPs), see SNA connections to LAN protocols.
  - **LAN SSAP:** contains a value from the SSAP listing of the line description that is associated with this controller description.
7. (Optional) For detailed information about all the parameters and their dependencies, see the chapter about communications controller descriptions in Communications Configuration .
8. Press Enter three times to create the description.

If you are using APPC, APPN, or HPR and would like additional information on creating controller descriptions, see Configuring APPC, APPN, and HPR.

## Create the SNA device description

The device description identifies the communications device that is used by the remote device. However, there are no LAN-specific parameters in the device description. To create the SNA device description, complete the following steps:

1. Find the create command to use. Use the GO CMDDEV command to view of list of available commands.
2. Type the name of the command and press F4 (Prompt).
3. Type the name of the device description into the corresponding field.
4. (Optional) For detailed information about all the parameters and their dependencies, see the chapter about communications device descriptions in OS/400 Communications Configuration .
5. Press Enter twice to create the description.



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## Chapter 5. Manage Ethernet support

Managing Ethernet support requires many tasks. The following links provide information about some basic steps in Ethernet management

- **Using an existing line description with iSeries Navigator**  
You will need to change some settings in the line description, and assign it to a TCP/IP interface.
- **Enabling objects to accept connections**  
If you are using TCP/IP, you will start the TCP/IP interface to enable objects to accept connections. For SNA you will need to vary on the line and controller descriptions
- **Viewing the LAN IOA address**  
You must specify the address of the remote input/output adapter (IOA) when configuring a controller description.
- **Configuration object commands**  
There are several ways to use and view object commands on your iSeries.

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### Use existing line descriptions with iSeries Navigator

You can use an existing Ethernet line description with iSeries Navigator by changing the description through any interactive job. However, you should ensure that all configuration objects (for example, TCP/IP interfaces) that currently use the line description are still able to work with it after you have changed it.

Use the Change Line Description (Ethernet) (CHGLINETH) command to change your line description. Then use iSeries Navigator to assign your line description to a TCP/IP interface:

#### Change your line description:

1. To vary off the line description:
  - a. Type **WRKLIND** and press Enter.
  - b. Locate your line description, and place your cursor in its Opt field.
  - c. Type 8 (Work with status) and press Enter.
  - d. Type 2 (Vary off) and press Enter. If your line description does not vary off, place your cursor on the error message and press F1 (Help) to view more information about the error. If you need some help with the error, see iSeries troubleshooting.
  - e. Press Enter.
2. Type **CHGLINETH** *description\_name* (where *description\_name* is the line description being changed) and press F4 (Prompt).
3. Specify the correct values for the Line speed field and the Duplex field. If you are not familiar with the input/output adapter (IOA), see Ethernet IOAs.
4. If you are using this line description with TCP/IP, ensure that source service access point (SSAP) X'AA' and its associated information are in the SSAP list field.
5. If you want to use the larger frame sizes of gigabit Ethernet, ensure that all the nodes along the communications path can support the frame sizes.
6. Press Enter to save your changes.

#### Assign your line description to a TCP/IP interface:

To use your line description with TCP/IP, you must associate the line description with a new or existing TCP/IP interface.

To associate the line description with a new interface, follow the procedures in Configuring TCP/IP over Ethernet. During the interface creation process, you will choose the line description that you have just changed from the list of line descriptions.

To associate your line description with an existing interface, complete the following steps:

1. You must have iSeries Navigator installed before continuing to the next step.
2. If this is the first time you are using iSeries Navigator to access your iSeries, use the wizard to configure TCP/IP on the server.
3. Expand the iSeries that has the line description, which you have just changed.
4. Select **Network—>Protocol**.
5. Right click **TCP/IP** and select **Interface**.
6. Double click the interface that you will associate your line description with.
7. Click the **Resource** tab and select your line description from the **Line name** option.
8. Click **OK** twice.

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## Enable objects to accept connections

After configuring LAN support, you are ready to enable your configuration objects to accept connections. For SNA, you vary on the line and controller descriptions. For TCP/IP, you start the interface.

### Vary on configuration objects for SNA:

To accept connections, you must vary on the configuration objects by using the Work with Configuration Status (WRKCFGSTS) command:

1. Type *WRKCFGSTS \*LIN* and press Enter.
2. Locate your line description.
3. Move your cursor to the Opt field of the line description, type 1 (Vary on), and press Enter.
4. If the line description does not vary on successfully, press F3 (Exit). Read Display message queues to understand how to view the error messages and to find possible solutions.
5. Press F3 (Exit).

If the line description varied on successfully, you should do the same for the controller description if you created one. Vary on the description by using the same instructions for varying on the line description. Instead of specifying \*LIN for the WRKCFGSTS command, you must specify \*CTL.

### Start the TCP/IP interface:

To enable the interface, use iSeries Navigator to complete the following steps:

1. In iSeries Navigator, Expand the iSeries that contains the TCP/IP interface to start.
2. Select **Network—>Protocol**.
3. Right click **TCP/IP** and select **Interface**.
4. You can start the interface now, or every time TCP/IP starts.
  - a. **To start the interface now:**
    - 1) Select an inactive interface.
    - 2) Click **Start**.
    - 3) Click **OK** to close the dialog box.
  - b. **To start the interface every time TCP/IP starts:**
    - 1) Double click the interface.
    - 2) Select **Start interface when TCP/IP is started**.
    - 3) Click **OK**.

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## View the LAN IOA address

When configuring a controller description, you must specify the address of the remote input/output adapter (IOA). To view the locally administered address or the preset address on the remote system, follow these steps:

### View the locally administered address:

To view the locally administered address, do these steps:

1. Type **DSPLIND** *description\_name* (where *description\_name* is the name of the description to be displayed) and press Enter.
2. Locate the Local adapter address field to view the address of the adapter.
3. Press F3 (Exit).

#### **View the pre-set address:**

To view the pre-set address of the remote IOA, do these steps:

1. Locate a line description that uses the IOA. This description must specify \*ADPT in the Adapter address field. If you cannot find such a line description, create it, and then return here to continue the steps.
2. Use the Work with Configuration Status (WRKCFGSTS) command to vary on the line description:
  - a. Type **WRKCFGSTS \*LIN** and press Enter.
  - b. Locate your line description and look for a status of varied on or active.
  - c. If it is varied on or active, press F3 (Exit) and skip to step 3.
  - d. If it is not varied on or active, place your cursor on the Opt field of the line description, type 1 (Vary on), and press Enter.
  - e. If your line description does not vary on, place your cursor on the error message and press F1 (Help) to view more information about the error. If you need help to understand the error message or to resolve it, see iSeries troubleshooting.
  - f. Press F3 (Exit).
3. Type **DSPLIND** *description\_name* (where *description\_name* is the name of your line description), and press Enter.
4. Locate the Local adapter address field to view the preset address of the adapter.
5. Press Enter.

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## **Configuration object commands**

You can view and use other commands that affect your line, controller, or device descriptions by using the GO command. To view a subset of the commands use the following GO commands:

- To view line description commands, type **GO CMDLIND** and press Enter.
- To view controller description commands, type **GO CMDCTLD** and press Enter.
- To view device description commands, type **GO CMDDEVD** and press Enter.

To view a more complete list of commands, use the following:

- To view line description commands, type **GO CMDLIN** and press Enter.
- To view controller description commands, type **GO CMDCTL** and press Enter.
- To view device description commands, type **GO CMDDEV** and press Enter.

The list below shows other related commands that you can use with your descriptions. To use one of these commands, type the name of the command (shown in parentheses) and press F4 (Prompt):

- Retrieve Configuration Status (RTVCFGSTS)
- Vary Configuration (VRYCFG)
- Save Configuration (SAVCFG)
- Restore Configuration (RSTCFG)
- Work with Configuration Status (WRKCFGSTS)





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## Chapter 6. Tune Ethernet performance

You can increase the data throughput of your server by adjusting the default values that are contained in your configuration objects. For guidelines and tips about adjusting these values, see the information:

- Tune LAN performance
- Increase Gigabit Ethernet performance

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### Tune LAN performance

If you change the default values of the LAN parameters, the performance of the connection or server may improve. The controller description contains these parameters. For information about these parameters, see SNA over ATM timing information. This asynchronous transfer mode (ATM) information also applies to LANs. However, you should not use the procedures there to change the parameters.

To change the LAN parameters, complete the following steps:

1. To view a list of commands that can change your controller description, type `G0 CMDCTL` and press Enter.
2. From the displayed list of commands, choose a command to change your controller description.
3. Type the command and press Enter.
4. Change the LAN parameters that you have chosen.
5. Press Enter to save your changes.

#### Other performance tips:

You can also find other performance tips here:

- Read the information about communications performance in the Performance topic in the Information Center. The Web site has PDF files that contain the reference. To view the reference, you must first download the file by clicking on a link. You should read the disclaimer under the special notice section before using any of the information.
- For more tips using SNA over your LAN protocol in Improving LAN performance.

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### Increase Gigabit Ethernet performance

You can improve the performance of the server by using these tips:

- Increase your maximum frame size. You must ensure that all devices along the communications path support the frame size.
- Monitor the performance of your LAN by using the monitors feature of iSeries Navigator. See Track performance for more information.
- See communications performance in the Performance topic in the Information Center. The web site has PDF files that contain the reference. To view the reference, you must first download the file by clicking on a link. However, read the disclaimer in the special notice section of the reference before using any of the information.



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## Chapter 7. Troubleshoot Ethernet

To find the available troubleshooting tools or troubleshooting help, see the following information:

- Troubleshooting LANs
- Physical network problems
- Connection failure and controller descriptions
- Remote system connection failure

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### Troubleshoot LANs

Your iSeries has tools to help you quickly find the problem and possible solutions. For an overview of the tools of your server and instructions on how to use them, see iSeries troubleshooting.

Also, you have these tools to help you:

- Test the communications path.
- Trace the network data to locate a problem.

**Note:** Although the information in the list pertains to the asynchronous transfer mode (ATM) network, it also applies to LANs.

IBM also provides a Web site that may contain solutions for you, see Global iSeries Technical Support



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### Physical network problems

If your adapter card cannot make a connection to the network, and the Product Activity Log points to a physical network problem, check the following problem areas:

#### Cabling problems:

- Check that your cable type is appropriate for the line speed you are using. For example, category 3 cable cannot be used for 100 Mbps.
- Is the cable wired correctly?
- Do all cables, patch cables, and patch panels between the iSeries and the network, switch or hub support your line speed? For example, if the line speed is configured at 100 Mbps, the cable must be category 5 to support the speed.

#### Possible solutions:

- If the cables have been excessively bent or stretched, the wiring inside the cable may have been untwisted, damaged, or even broken. Try reseating the cable or temporarily replacing it with a functional one.
- Make sure that you are not using crossover cable.
- Route the cable away from electrically noisy devices, such as fluorescent lights, printers, copiers, or electric motors. These items can cause interference with data transmissions.
- Try plugging the cable into a different switch or hub port.
- Check that the switch or hub has the latest software from the vendor.
- You may want to add lightning protection to your network cabling and switch or hub power lines, if you live in a lightning prone area. A direct strike can cause a large power surge, which can severely damage your networking equipment and cabling.

#### Configuration problem checks and solutions:

- Check that the line speed and duplex mode chosen in CRTLINETH are the same as the parameters programmed into the switch or hub port. One frequent cause of problems is a duplex or line speed mismatch

**Note:** To use the \*AUTO configuration for line speed or duplex mode, you must configure both of the parameters to \*AUTO. Do not use line speed and duplex configurations of 10/AUTO, 100/AUTO, AUTO/Half, or AUTO/Full. These configurations might work, but you will have frequently unsuccessful and incorrect connections.

- Try varying the line off and then on again with \*RESET. Do not use \*RESET if an MFIOP is the IOP! This could shut down the entire machine because other devices that share the MFIOP will not be able to access the line.
- If you suspect the adapter may be faulty, run VFYCMN with an external wrap plug attached. If this test is passed, the adapter card is not likely to be the problem.
- Connect a LAN analyzer to verify that the actual line speed and duplex mode being used on the link between the iSeries and the hub or switch is accurate.

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## Connection failure and controller descriptions

Sometimes an incorrectly configured controller description can cause a connection failure. The problem source could involve the incorrect configuration of the adapter address, source service access point (SSAP), or destination service access point (DSAP) parameters.

For more information about how these parameters influence a successful connection, see LAN device identification. For other causes of a connection failure, see LAN device connection initiation.

### The remote system does not connect:

If your controller description uses dial mode, it is not unusual for the system to receive message CPA58E0 (Controller not replying) or CPA57EF (Contact not successful). Remote systems or controller descriptions that do not vary on can cause one of these messages to appear.

### Your server does not connect:

If your controller description uses answer mode, you may receive the message CPI591A (Controller is varied off or not recognized by local system). The following situations can cause this message to appear:

- The connection requested by the remote system does not exist on the local server. The local server searches for this connection (that is indicated by combining the local adapter address, the DSAP, and the SSAP) in all varied on controller descriptions.
- The controller description does not refer to the line description that could answer the call.

### Solutions:

- On either side of the connection, verify that the controller description has the correct combination of adapter address, SSAP, and DSAP.
- In the Switched line list field of the controller description, enter the line description that can accept the incoming call. .
- Vary on the correct controller description (use the Work with Configuration Status (WRKCFGSTS) command to vary on the controller).
- Verify that the local and remote adapters are wired into the network correctly.

For information about the relationship between line descriptions and controller descriptions, see Connect LAN devices

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## Remote system connection failure

If a remote system cannot connect to your iSeries, there are several areas you need to check. If the remote device is polling your server, but the system operator message queue does not contain a message regarding your system being polled, check the Product Activity Log for messages regarding line descriptions and system reference code AF06.

See Display the Product Activity Log for complete instructions and links to more information.

A connection failure can occur if the remote system uses a destination service access point (DSAP) that your line description does not refer to. Another possible cause could be that the line description that contains the correct DSAP is not in the Switched line list field of the correct controller description. If the AF06 system reference code is absent, the error might still have occurred. Verify that the adapter address, SSAP, and DSAP values for both your server and the remote system are correct.







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